Effect of Utility Deregulation and Mergers on Consumer and Producer Welfare

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ABSTRACT

In the late 1990s many US states deregulated their electric utilities, allowing for competition among power generators. As a result there was a significant merger wave among large utility companies. To-date the effect of utility deregulation on electricity prices is unclear, as are the benefits to merging utility companies. This study examines these effects by analyzing statewide electricity price changes among deregulated and regulated states from the period 2001 through 2012. In addition, the study examines post-merger abnormal returns relative to a basket of utility stocks among acquiring firms over this time period. The findings are that utility deregulation initially had little effect on electricity prices, but later, in the years during and after the financial crisis, electricity prices in deregulated states grew at a slower rate than they did in regulated states. In addition, we find that the initial abnormal returns to the merging firms were high as investors believed firms would capture much of the gains from deregulation. A few years after deregulation, however, abnormal returns to merging firms were insignificant.

Keywords: Deregulation, Mergers, Regulated Industries, Event study

JEL Codes: L98, G34, G14
I. Introduction

As of the writing of this paper, deregulation of electric utilities in the U.S. has been in place in many states for 15 to 20 years. Deregulation was instituted to create efficiencies through competitive power production and, therefore, lower retail (consumer, industrial, and commercial) electricity prices. Studies to-date, however, have not shown deregulation to have a definitive impact on the growth in electricity prices.

Utility deregulation was initiated in the early 1990s via the 1992 Energy Policy Act (EPACT). EPACT 1992 created a new category of corporations, exempt wholesale generators (EWGs), which were allowed to own generators and sell electricity at wholesale anywhere in the world. (Hempling, 1995) The goal was to create a more efficient system and, therefore, lower prices; in addition regulators were hoping that prices would become more uniform between states. The deregulation of utilities was part of a trend to deregulate industries, which were previously perceived to be natural monopolies. A decade earlier, the U.S. deregulated the telecommunications industry with great success resulting in a precipitous drop in the price of long distance phone calls to their marginal cost or just above zero by the end of the 1990s. More closely related, the US natural gas industry was deregulated in the 1980s and 1990s, which resulted, in part, in lower natural gas prices nationwide. Many, therefore, expected that deregulating electric utilities would have a similar effect of lowering prices.

Most of the states that deregulated, did so in the late 1990s or early 2000s. Electricity deregulation then spurred a wave of mergers. Mergers occurred among rival power producers, as well as among utilities seeking to vertically integrate or even to diversify between gas and
electricity. Acquirers believed they could benefit from scale in procurement, production, etc. In addition, a merger may enable a firm to acquire an inefficient utility and improve the management of the firm, post deregulation. While deregulation has been studied to a great extent, few studies have focused on the gains or losses to the merging utilities after deregulation.

Over the past several years the pace of deregulation has diminished with generally high priced or high cost states having already deregulated and other states remaining regulated. Part of this standoff can be explained by the uncertainty regarding the net benefits of deregulation. This study seeks to understand some of the effects of electricity deregulation. To do so I examine the effects that deregulation and mergers have had on the growth in annual electricity prices in each of the 50 U.S. states and the District of Columbia from 2001 through 2012. In addition, the study seeks to understand the effect of the merger wave in electric utilities on investor returns. To do so, I use an event study technique to calculate the post-merger cumulative abnormal returns that the acquirers achieve relative to a comparable utility index.

The findings from this study are that deregulation helped slow the growth in electric utility prices over time, particularly as large, industrial customers adopt retail choice to choose their power provider. Regarding mergers, I find that overall, they do not have a significant effect on the growth in electric utility prices; however, mergers do appear to have a negative effect (lower growth) on prices in deregulated states in the years 2008-2012 (termed the post financial crisis period). Finally, relating to abnormal returns to mergers, I find that, while the overall abnormal returns to the merging utility are low and insignificant, there is a discernable difference between the abnormal returns in the early stage of deregulation versus the later stage. In the earlier stage I find significant, positive intermediate and long term abnormal returns, while I find
significant negative, intermediate and long term abnormal returns to the merging utility in the latter stage of deregulation. Note: This finding will be re-evaluated when more data becomes available.

The layout of the paper is as follows. Section II discusses the relevant literature. Section III discusses my data and empirical strategy. Section IV presents the regression results, and Section V provides some concluding remarks.

II. Literature Review

Considerations regarding deregulation

Arguments for utility deregulation focus on improved technological efficiency, eliminating regulatory capture, promoting innovation, and introducing competition to lower industry prices. It has been argued that when an industry is deregulated, unrestricted competition and entry help promote innovation and force firms to shed costs. Winston (1998) Also, industry regulation may promote inefficient capital allocation, particularly when a regulator determines a firm’s profit as a percent of its capital investment. (Averch and Johnson, 1962) Winston (1998) further adds that regulation hampers firms from efficiently reacting to industry shocks as regulated firms have to gain regulatory approval to change their rates, losing valuable time to properly respond to an industry event.

Electricity deregulation was feasible in the US, according to Becker-Bease et al. (2008), in large part because the rationale that electric utilities are a natural monopoly was becoming obsolete with the technological advances. These improvements included changes in the size and efficiency of gas turbines, thus allowing far smaller units to be used to generate power. As a
result economies of scale may not be as prevalent in power production as previously considered. Also, there were improvements in transmission lines enabling electricity to be shipped across multiple regions. With technological advances the natural monopoly arguments for regulating utilities have been challenged. Empirical studies\(^2\) differed regarding the significance of economies of scale in the US electric utility industry pre-deregulation. Also, deregulation advocates argued that regulatory commissions were often captured by industry, so it is best to introduce competition, particularly in the generation of electricity. (Becker-Bease, et al. 2008)

California, Massachusetts, and Pennsylvania were the first to adopt utility deregulation in the late 1990s. A decade later 17 states plus the district of Columbia have deregulated electricity. Prior to 1992, electric utilities in the US were all regulated from electricity generation to delivery at the state level. Still, the US electricity market consisted of a large number of independent power producers, often with many coexisting per state. This market structure differed from the single firm monopoly structure in most other countries, and was thus well suited for competitive, wholesale markets. (Pelzman and Winston, 2000)

As such, pilot experiments were set up in certain states with the goal of enabling consumers to obtain lower electricity prices from independent start-up companies, many who presumably use the latest technologies and have lower costs structures than older incumbent utilities. The incumbent utilities often have large sunk costs of plant and equipment already installed and may have contractual commitments to buy independently generated power at very high rates. Deregulation programs were then implemented in many states starting in the late

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1990s and early 2000s. Interestingly, much of the deregulation occurred in the high cost states, particularly in the Northeast. Prior and subsequent to deregulation significant differences in electricity prices existed by state. These differences can be attributed in part to different natural resource endowments across regions as well as poor investments and contract decisions made in the 1970s and 1980s in certain states. (Borenstein and Bushnell, 2000)

Utility Deregulation Studies

A number of studies were published in the 2005 and 2006 timeframe examining the effect of electric utility deregulation. These included studies by Cambridge Research Associates (CRA) (2005), Joskow (2006), Taber, Chapman and Mount (2006), Fagan (2006), and Law and Consulting Group (2006). These studies provided little evidence of gains in efficiency or benefits due to deregulation in the United States (Adams, 2008). The methodological approaches of these studies differed, but can generally be classified, according to Kwoka (2008) in four ways. First, the study compared electricity prices in regulated versus non-regulated states. Second, the study compared intensity of regulation. Third, the study predicted the effect of deregulation in a laboratory experiment, and fourth, the authors developed a model to estimate demand, costs, etc. to predict the effects of deregulation. This study follows the first approach.

Kwoka (2008) points to several problems with these studies, most significant of which are the complexities of deregulation. Electricity deregulation\(^3\), Kwoka (2008) asserts, was often a phased approach, versus an event in a single year. In addition, pre and post reform prices were not consistent due to initial rate freezes followed by rate freezing as well as divestment of

\[^3\text{Much of this paragraph was taken from Kwoka (2008).}\]
generation assets. Also, deregulation allowed for recovery of stranded assets, which were fixed investments that the utility was not likely to recover in a competitive market. These effects then would dissipate over time. Finally, Kwoka (2008) argues that there was excessive expansion of generation capacity around 2004, which depressed prices for a period thereafter, and thus masked the effect of deregulation.

Kwoka (2008) also contends that there are often measurement problems in deregulation studies. He suggests the empirical studies should use fixed effects by state and employ a difference in difference method when appropriate to examine price differences before and after deregulation. This method was considered, but would require data going back to the early 1990s.

Few studies examined the effect of electricity deregulation by state. White (1996) provided state-by-state evidence on the distribution of potential gains to consumers (and losses to utilities) from predicted deregulatory reforms. He affirmed that new power production facilities can be developed by entrants at average costs well below those of many incumbent utilities. Entrants should thus translate into lower electricity prices. I need to look more closely to find more recent literature covering state by state electricity price studies.

IIb. Mergers and responses to industry deregulation

Firms have often responded to deregulation by merging with rivals. This trend was observed in the deregulation of railroads, airlines, and banks with mixed results found on social welfare. Winston (1998) elaborates that end-to-end mergers have helped railroads become more efficient, but parallel mergers may have reduced competition between railroads while producing
few efficiency gains. Similarly, some airline mergers have been found to enhance social welfare, while others have not. (Winston, 1998)

Adams (2008) adds that with the introduction of competition in the industry via deregulation, shareholder wealth can suffer due to the existence of stranded assets, increased market and firm specific risk, and possible transfers of wealth from producers to consumers. Indeed, it is possible that a utility, which loses its monopoly power due to deregulation, will see the value to its owners decline by the present discounted value of expected future monopoly profits. In fact, Adams (2008) reports that deregulation had a deleterious effect on utility stock prices during the time of deregulation, as in 1999 (the first year many states deregulated), electric utility share prices declined sharply\(^4\). It is, therefore, reasonable for utilities to merge as a defensive move to retain their market power.

There are many studies that analyze merger effects by assessing investor sentiment at the time of the merger. To do so, researchers often estimate pre-merger abnormal returns to the acquirer and/or target surrounding the merger announcement. These studies generally show the abnormal returns to the acquirer during the merger event announcement window to be zero or negative, while the returns to the target are positive, suggesting the returns from the merger are captured by the target stockholders.

In addition, some studies have analyzed post-merger abnormal returns to the merged firms. These studies have the advantage of potentially explaining the actual effect that the merger has on the returns to the company. However, the studies run into a number problems,

\(^4\) The Dow-Jones Utility Average index tracking 15 stocks declined in the last six months of 1999 by 14.7%, due in part to uncertainties over deregulation.
most noteworthy of which are measurement problems relating to the calculation of abnormal returns, determining the relative significance of the merger versus other events, and assessing the effect of the merger over time. Agrawal et al. (1992) were one of the first to develop a method for analyzing post-merger abnormal returns, and they found a mean underperformance of roughly 10 percent of the merged companies relative to the market index in the study. They attribute this underperformance either to issues unrelated to the merger or to the market being slow to adjust to the merger announcement.

More closely related to utility mergers, Becker-Bease (2008) used the event study technique to explore the connection between merger activity and deregulation following deregulation in the electric utility industry in the 1990s. They find that while investors initially believed utility mergers will enhance value based on the 3-day window abnormal returns, the returns dissipated by the time the deal closed and the post merger abnormal returns were generally negative. They conclude that electric utility mergers as a response to deregulation generally did not create value for shareholders. These findings contrast with Bartunek et al.’s (1993) earlier study covering markets undergoing deregulation, whereby they find that the overall effect of mergers pre-deregulation is positive, but the magnitude of the effect is less than it would have been without regulation. Loggins and Lien (2000) had performed a study similar to Becker-Bease’s (2008) and found insignificant announcement returns, but noted that firms making product focused acquisitions experience negative returns, while those making diversifying acquisitions experience insignificant returns.
Another potential explanation for post-merger abnormal returns is whether the merger occurred as part of a merger wave. Mitchell and Mulherin (1996) suggested that merger waves are driven by technological or regulatory shocks, which are likely to increase the level of uncertainty in the industry. Duchin and Schmidt (2010) investigate how merger waves affect stock market performance and find that in-wave mergers result in worse performance, which they argue is due to poorer firm governance than out-of-wave mergers.

Berry (2000) also examines mergers of electric utilities to include electricity and natural gas companies. Berry (2000) finds, like others, that there are positive returns to targets but not to acquirers. Also, in comparing horizontal mergers (electric/electric) with diversifying (gas/electric) mergers, he concludes that markets reacted more positively to the diversifying mergers, indicating opportunities for shareholder gains in those cases. Berry (2000) I will explore the effect that horizontal versus diversifying mergers have on the post-merger abnormal returns of acquirers in this study.

III. Data and Empirical Methodology

IIIa. Price analysis

This paper examines the effect of electric utility deregulation and mergers have on consumer and producer welfare over a 12 year period from 2001 to 2012 (I plan to extend the analysis to 1999 and possibly out to 2014 in a later draft). As of the end of the year 2012, there were 17 states plus the District of Columbia where electricity generation was deregulated in some manner, meaning that customers have a choice of generation suppliers. Figure 1 shows
each of the U.S. states, illustrating whether electricity is regulated or has been deregulated. We see from the map that most of the states that deregulated are in the higher cost, Northeastern states. Among the regulated states, six states (California, Arizona, Virginia, West Virginia, New Mexico, and Nevada) deregulated and then re-regulated because of poor experience with deregulation. These states have been listed as regulated\textsuperscript{5} for the purposes of this study.

To analyze the effect on consumer welfare, I utilize data from the US Energy Information Agency (EIA) on total\textsuperscript{6} annual electric utility prices by state. In addition, the EIA provides the total, annual number of electric utility customers by state. This information helps assess demand usage. Also, I gathered the percentage of industrial, commercial, and retail customers in each state that use the retail public choice option.

Figure 2 shows average annual utility prices for all sectors, and differences in electricity prices between regulated and non-regulated states. From the graph we see that deregulated states have higher electricity prices in all years under review. However, it appears that since 2008, the period of the financial crisis, the average electricity prices is converging between regulated and deregulated states. This finding contrasts greatly with an earlier EIA finding in 2007 showing the difference in electricity prices between regulated and deregulated states to be actually diverging.\textsuperscript{7}

To assess the effect of deregulation, mergers, and other factors on the growth in utility prices, I used the Arellano-Bover/Blundell Bond General Method of Moments (GMM\textsuperscript{8}) method.

\textsuperscript{5} California was listed as deregulated in 2001 and regulated in all other years.
\textsuperscript{6} Includes residential, commercial, industrial, and other segments.
\textsuperscript{7} See http://www.publicpower.org/files/PDFs/10year.pdf.
\textsuperscript{8} Autoregressive integrated moving average (ARIMA) can also be used as a dynamic model. The GMM method
This estimator is often used in studies under the assumption that current year dependent variable is a function of last year’s dependent variable. In this case when using a lagged dependent variable as a covariate, OLS is not an appropriate estimation technique because the unobserved panel-level effects are correlated with the lagged dependent variables making standard estimators inconsistent. The Arellano-Bover/Blundell Bond model corrects the error correlation problem by using the lagged levels of the dependent variable and possibly other variables as instrumental variables. (Greene, 2003) This model certainly seems appropriate given that regulated utility prices have historically been set based in part on prior year rates.

The regression equation I use for this analysis is the following:

\[ \lnPrices_i = \beta_1 + \beta_2 \text{lagged Prices}_i + \beta_3 \text{De-Regulated}_i + \beta_4 \% \text{CustType}_i + \beta_5 \text{Merger}_i + \beta_6 \text{Mergervalue} + \beta_7 \text{Merger} \ast \text{Deregulated}_i + \beta_8 \text{FinCrisis} + \beta_9 \text{FinCrisis} \ast \text{Dereg} + \beta_{10} \text{FinCrisis_merge} + \epsilon. \]

Lagged prices refers to the prior year prices, logged, with i referring to the year. Deregulated refers to the years where retail choice programs were implemented among the 18 states and the District of Columbia, with a one (1) referring to a deregulated state. All of the deregulated states in the database implemented a retail choice program throughout the period (2001-2012) of the study, except for California who suspended their program in 2001 and then resumed the program in 2010. Customer type refers to percentage of industrial, commercial, and retail customers by year who use the retail choice option to choose the utility generation provider in a deregulated state. As shown in the summary statistics in Table 1, few retail customers (8.1%) use the retail choice option, but a larger percent of commercial (37%) and industrial

was chosen as it has advantages when some of the variables are potentially endogenous.
customers (45.8%) in the deregulated states used the retail choice option. Merger refers to the year of the merger announcement and all subsequent years after the announcement. The dummy variable is placed in the state where the target is located. From this variable I am testing the effect of utility consolidation. We also see from Table 3 that 49% of the years in deregulated states underwent consolidation via a merger, while only 10% of the years in deregulated states had consolidation of supply from a merger.

Merger value refers to the transaction size of the merger in the year the merger was announced and all succeeding years. In cases where more than one merger occurred in a state, as in New York, with five mergers and Pennsylvania with three mergers, the transaction values were added together in the year of the merger and all the years that followed. Financial Crisis is a dummy variable with a one (1) referring to the years 2008 to 2012 and zero (0) referring to 2001 to 2007. The timeframe for this variable corresponds with the apparent inflection point when the growth in electricity prices in deregulated states appeared to decelerate as shown in Figure 2. I also interact Financial Crisis with deregulation and merger to assess the effect that these variables have jointly on the growth in electricity prices. My hypothesis is that deregulation had a negative effect on the growth in electric utility prices in the post-financial crisis period, while mergers had a positive impact on electricity prices in this period.

IIIb. Merger Analysis

To assess producer welfare I analyzed a set of 40 mergers (23 analyzed at this point) among electric utility utilities who engaged in a merger with a transaction size of greater than

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9 Many targets are located in multiple states. In these cases, I placed the dummy variable in the state where the target is headquartered, under the assumption that the target would likely generate the largest percent of its output in that state than in others.
$50 million between January of 2000 and December 2012. The data was gathered using SDC Thomson Data database. Stock market data was gathered using the CRSP data base.

I use an event study framework similar to Agrawal et al. (1992), Dimson and Marsh (1986), Lakinishok and Vermaelen (1990), and Sonenshine and Feinberg (2014) whereby abnormal returns are calculated by taking the difference between the post-merger stock market returns for the merged firm and the returns of a related market. The Agrawal et al. (1992) method is summarized in the following equation,

\[
(2) \quad AR = R_{it} - R_{bt} - (\beta_i - \beta_b)(R_{mt} - R_{ft})
\]

\(R_{it}\) refers to the monthly returns for each merged company with \(t\) referring to the month of the merger announcement date. As such, the variation in the stock price at or before the merger announcement is not included in the monthly returns. Stock market returns (excluding dividends\(^{10}\)) on the acquirers were gathered using the CRSP database. \(R_{bt}\) refers to the returns to the index for the benchmark group from the time of the merger announcement to the period of interest (12, 36, or 60 months). I use the Vanguard Utility ETF\(^{11}\) as the Benchmark for this study.

This amount \((R_{it} - R_{bt})\) is then adjusted by the risk–adjusted equity market return\(^{12}\) \((R_{mt} - R_{ft})\) over the one, three, and five year period to account for the influence of the equity market on the post-merger return. \(R_{mt}\) refers to the return to the market measured by the S&P 500 monthly

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\(^{10}\) Dividends are excluded in the stock market returns to the company to provide an equal comparison between the company and the returns to the benchmark. The benchmark used in this study is Vanguard Utility ETF, not including dividends.

\(^{11}\) This ETF appears to be a suitable benchmark since it only contains US utilities, and it is heavily concentrated in large US utilities.

\(^{12}\) Calculated as the difference between the market (S&P 500) return and the risk-free (90 day Treasury Bills).
returns, while \( R_f \) refers to the risk-free rate measured by the 90-day Treasury bond return. The equity market return is also adjusted by the Beta of the security \((\beta_i)\) and the utility benchmark index \((\beta_b)\) to account for how they are influenced by the market. Betas are estimated by regressing 60 month post-merger returns for both the security and the utility benchmark index against the market or S&P 500.

Abnormal returns are summed for 12 months, 36 months, and 60 months to obtain CARs as follows:

\[
(2) \text{CAR} = \sum_{i}^{n} \text{AR}_i
\]

Results from the CARs are shown in Tables 2 and 3. Table 2 shows the total results, while Table 3 segments the results between mergers that occurred in the early stage of deregulation (2000-2003) and mergers that occurred after 2003 and thus are referred to as late stage mergers.

We can see in Table 2 that the average one year CARs are small and insignificant. It is not surprising to see negative one year returns given the tendency for investors to sell the acquirer at the time of the merger announcement. In contrast, the three and five year CARs were higher overall, but still insignificant.

From Table 3 we see that the three and five year CARs to acquirers were very high and significant for those firms undertaking a merger in the early stage of deregulation. In contrast, the CARs were negative though not significant to those firms undertaking a merger after 2003.

Upon gathering more data, I will explore reasons behind this finding with separate regressions.
Certainly, concerns\textsuperscript{13} have been raised regarding the validity of calculating post-merger CARs over a long period of time. One concern is the bias in test statistics, related both to the difficulty in specifying an appropriate index or reference portfolio over long periods and to skewness in the distribution of long-run abnormal returns. (Sonenshine and Feinberg, 2014) Also, the significance of the merger to the overall performance of the company varies by merger and likely dissipates over time. While calculating the CARs provides some intriguing results, I am largely interested in the factors that influence the CARs. To estimate how deregulation, the type of merger, and the timing of the merger impact the post-merger CARs, I used the following equation.

\[ \text{CARs} = \beta_1 + \beta_2 \text{deregulation}_i + \beta_3 \text{Early\_Late}_i + \beta_4 \%\text{Transaction\_Val}_i + \beta_5 \text{Diversification}_i + \beta_6 \text{State}_i + \epsilon. \]

Early\_Late refers to the timing of the mergers, with a (1) signifying an early stage merger occurring in the years 2000 to 2003, a time period when states were adopting deregulation. A zero (0) indicates a later stage merger. This sample includes (7) early stage and (16) late stage mergers. More data will be gathered to bolster the sample, particularly in the early stage. Diversification refers to a merger between two differing vertical levels, generation and transmission and/or distribution. Diversification may also refer to the merger of a predominantly natural gas or natural gas / electric utility company and an electric utility company; a zero (0) was used to refer to a horizontal merger, and a one (1) refers to a diversifying merger. Also, State refers to whether the merger involves firms that predominantly operate in the same state (0).

\textsuperscript{13} See Lyons (1999) and Mitchell and Stafford (2000) for discussions of some of the major reservations about biases in these test statistics.
Finally, transaction value refers to the reported value or absolute size of the merger. I may include the relative size or ratio of sales as well in a later draft when more data is available.

Table 4 shows summary data for the mergers. Here we see the average size transaction to be $4,304 billion with a significant variance in merger size ranging from $56.5 million to $25,818 million. We also see that 78 percent of the mergers occurred in deregulated states. In addition, as shown in Table 4, 66 percent of the mergers are classified as diversifying mergers, with 34 percent being horizontal mergers. We do not identify the type of diversification (e.g. due to vertical integration or product mix). Also, we see from the table that 73 percent of the mergers occurred in multiple states (acquirer and target located in different states). Finally, we see that 30 percent of the mergers are classified as early stage mergers.

IV. Results

Table 5 shows the results from the electric utility price regressions. The first column provides findings for the 549 total observations in the 50 groups. (I accidentally omitted Louisiana, so there should be 51 groups for the 50 states plus DC). Columns 2 and 3 show the results for the restricted samples of 18 deregulated states (includes California) and 32 regulated states. Columns 4 and 5 then show the results for the pre-financial crisis (2001-2007) and post financial crisis (2008-2012) periods. Finally, column 6 shows the results only in the years when there was consolidation from a merger, with most of the observations found in deregulated states.

From the Table 5 we see that prior year prices have a strong effect on current year prices with

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14 Late stage mergers had a slightly higher average transaction value ($4,693) versus ($3,414) for early stage mergers.
a coefficient of .898, suggesting a .9 percent increase in prior year prices leads to a 1 percent increase in current year prices. The coefficient does not vary greatly between regulated and deregulated states. However, we do see a far smaller coefficient for lagged prices (logged) for the post financial crisis then the pre-financial crisis period. This result may have been driven by the economic downturn in 2008/2009, which may have put pressure on electricity prices. Also, we see that the log of customers is negative and significant in the post-financial crisis time period as well as in all observations, but not significant in the pre-financial time period. These results together suggest that there may have been some changes in the growth in prices in the years 2008-2012 or during and after the financial crisis versus before the crisis. We also find a slight difference (a coefficient of -.16 versus -.09) in the effect of growth in customers on change in prices in the deregulated versus regulated states. This finding would suggest that market forces are playing a greater role in electricity pricing in deregulated states with growth of customers lowering the growth in electricity prices to a greater extent.

Also from Table 5 we find the coefficient for deregulated states is positive and significant, suggesting that the growth in prices in deregulated states is higher than the growth in prices in regulated states. This finding would suggest that deregulation has not had the intended effect of lowering the growth in electric utility pricing. We will look to columns 4 and 5 to see if there are differences in the growth in electricity prices pre and post financial crisis, between regulated and deregulated states. We also see the coefficient for mergers to be positive and significant indicating the growth in electricity prices in the years where utility mergers occurred, regardless of size, resulted in higher prices than in years when mergers were not announced. The coefficient of transaction value, however, is not significant indicating that the size of the merger,
which is a proxy for the level of consolidation, did not have an effect on the growth in electricity prices.

To try to understand, how deregulation may be affecting the growth in electricity prices, I examine the percent of each customer segment within the deregulated states that had a retail choice option. The percentages as shown in the summary statistics were generally small for retail customers and higher for industrial and commercial customers. From Table 5, we see that overall within deregulated states the coefficient for the percent of industrial customers on retail choice programs is positive and significant, while the coefficient for the percent of retail customers on retail choice programs is negative and significant in their effect on the growth on log utility prices. These effects, however, change in the post financial crisis period where we find the coefficient to be negative and significant among industrial customers and insignificant for retail customers. These findings may suggest that in the initial stage of utility deregulation the percent of large customers has a positive effect on prices, perhaps due to the disruptive nature of deregulation. However, in time the percent of industrial utility customers has a negative impact on the growth in utility prices, suggesting deregulation would have a positive effect on consumer welfare at least relative to large customers. For retail customers the coefficient is negative and significant in the pre-financial crisis period indicating that growth in electricity prices may decline with the increased percent of retail customers choosing retail choice programs. However, this effect may dissipate over time.

Finally, we turn to the financial crisis variable which has a positive, significant coefficient in the overall sample as well as a positive significant coefficient in the regulated states sample. This result is consistent with Figure 1, suggesting that the growth in utility prices in the post
financial crisis period was driven by the regulated states. This result would indicate that
deregulation had a positive effect in lowering the growth in utility prices from 2008 to 2012. We
find further evidence of the positive effect since the coefficient of the interactive term Financial
Crisis*deregulate is negative and significant in its effect on the growth in electricity prices in the
total sample and in the merger sample.

Finally, we see in column one that the coefficient for the interactive term for financial crisis
and mergers is negative and significant suggesting that mergers may lead to lower utility prices
in the post-financial crisis period. This is an intriguing finding, since as shown in Table 3, the
cumulative abnormal returns to the merged firms were positive in the early stage of deregulation
and negative in the late stage of deregulation. Possibly in the later stage of deregulation
competition was effective in lowering prices, thus improving consumer welfare at the expense of
producer welfare.

To examine the effects on producer welfare, I look at the factors influencing the cumulative
abnormal returns (CARs) as shown in Table 6. Here we see the coefficient for deregulation to be
positive and weakly significant when regressed against one year CARs, suggesting that abnormal
returns are higher when the merger occurs in a deregulated state. Deregulation remains positive
but loses significance when regressed against three and five year CARs. This finding suggests
that investors may at first be enamored with the prospect of abnormal returns to the merged firm
in a deregulated state. However, over time investors may be finding that consolidation among
utilities may not be positively impacting profitability as expected in deregulated states. We also
see that coefficient for transaction value to be negative and significant when regressed against
one year CARs, but insignificant when regressed against three and five year CARs. This finding
is consistent with other studies, such as Sonenshine & Feinberg (2014), who find that diseconomies are created from acquiring rivals in large mergers, perhaps due to the substantial costs that are created when merging large firms. Note: I plan to look at sales ratio to assess the effect of relative size of the companies engaged in the merger. To date, I am missing data.

The other key finding we see from Table 6 is that the coefficient for the Early stage period is positive and significant for three and five year CARs. This finding would suggest that merging firms in the early period of deregulation (2000-2003) generated higher long term, abnormal returns. There are many possible explanations for this finding. Possibly, in the early stages of deregulation there were opportunities for firms to gain abnormal profits, by gaining greater control over electricity supply and/or transmission. These opportunities may have dissipated in time as more supply was brought on-line and the idiosyncrasies of deregulation were worked out. As such, the CARs from mergers in the late period were negligible. Another possible explanation is that, the inefficient or poorly managed utilities were acquired early on, while later the mergers entailed relatively well-managed firms, which are hard to improve on or difficult to wring out costs to increase profitability.

Finally, in examining the results in Table 5, we see that neither the coefficient for multi-state nor the coefficient for diversification is significant in each of the regressions. (I do find differences when segmenting the sample between early and late periods. I do not show this finding at this time given the small sample size).

V. Conclusions

This study examines the effect of electric utility deregulation and mergers on consumer
and producer welfare. To do so, I examine how deregulation and mergers affect electric utility prices and the cumulative abnormal returns to merging firms. I find that while electricity prices are higher and overall grew faster in deregulated states than regulated states, the growth in electricity prices may be lower in deregulated states from 2008 to 2012 than in regulated states. We also see that the intensity of customers using the retail choice option plays a role in the impact of deregulation, with the level of industrial customers having a negative impact on the growth in electricity prices in the post financial crisis period. In summary, the effect of deregulation on the growth in electricity prices seems to vary with a positive effect (higher growth in prices) in the pre-financial crisis period and lower growth in prices in the post financial crisis. This effect is found in deregulated states and in states where mergers occurred.

Regarding the impact of mergers, we find positive cumulative abnormal returns to merging utilities in the early stage of deregulation and negative in the later stage of deregulation. The cumulative abnormal returns were also positively affected by the merger occurring in deregulated states, at least for one-year CARs.

In summary, I find that deregulation does appear to have a positive effect on consumer welfare in the later years of deregulation. In contrast, the opportunity for merging firms to capitalize on deregulation may have only been available in the early stage of deregulation. While this study has examined the effect of deregulation and mergers on consumer and producer welfare, it is left to other studies to assess other aspects of deregulation, such as differences between kinds of vertical mergers or differences in scope of deregulation.
References


Cowing and Smith (1978).


Figure 1:

Electricity retail choice states, 2010

States with electricity retail choice programs = 17 states plus District of Columbia
States without electricity retail choice programs = 33 states

Figure 2

Trend in Electricity Prices - Regulated vs Deregulated States
Table 1: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Retail customers- retail choice</td>
<td>.081</td>
<td>.13</td>
<td>0</td>
<td>.6</td>
</tr>
<tr>
<td>Percent commercial customers – retail choice</td>
<td>.37</td>
<td>.27</td>
<td>0</td>
<td>.85</td>
</tr>
<tr>
<td>Percent industrial customers – retail choice</td>
<td>.458</td>
<td>.33</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Percent of years with a merger- deregulated states</td>
<td>.49</td>
<td>.4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Percent of years with a merger- regulated states</td>
<td>.10</td>
<td>.3</td>
<td>0</td>
<td>1</td>
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Table 2: Mean CARS Overall and by Time Period

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<thead>
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<th>Mean CARs Overall</th>
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<tbody>
<tr>
<td></td>
<td>1-year</td>
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<tr>
<td>Mean</td>
<td>0.4%</td>
</tr>
<tr>
<td>Standard error</td>
<td>4.4%</td>
</tr>
<tr>
<td>T statistic</td>
<td>-0.1</td>
</tr>
<tr>
<td>Range</td>
<td>-62% to 23%</td>
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<td>n</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Early Deregulation Stage</th>
<th>Late Deregulation Stage</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1-year</td>
<td>3-year</td>
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<tr>
<td>Mean</td>
<td>4.4%</td>
<td>32.8%</td>
</tr>
<tr>
<td>Standard error</td>
<td>9.5%</td>
<td>13.1%</td>
</tr>
<tr>
<td>T statistic</td>
<td>0.55</td>
<td>2.56***</td>
</tr>
<tr>
<td>Range</td>
<td>-</td>
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</tr>
<tr>
<td>n</td>
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</table>
Table 4: Summary Statistics

<table>
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<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
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<tr>
<td>Transaction value</td>
<td>4,304</td>
<td>5,666</td>
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<td>25,818</td>
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<tr>
<td>Regulated (0) vs. Deregulated states (1)</td>
<td>0.78</td>
<td>.42</td>
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<td>Horizontal (0) vs Diversification (1)</td>
<td>0.34</td>
<td>0.48</td>
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<tr>
<td>Single state (0) vs Multi-State (1)</td>
<td>0.73</td>
<td>0.45</td>
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<tr>
<td>Late stage (0) vs Early stage (1)</td>
<td>0.30</td>
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Table 5: Regression Results - Prices

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<th></th>
<th>(1) All Observations</th>
<th>2) De-Regulated States</th>
<th>3) Regulated States</th>
<th>4) Pre-Financial Crisis</th>
<th>5) Post-Financial Crisis</th>
<th>6) Mergers</th>
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</thead>
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<tr>
<td>Lag prices (logged)</td>
<td>0.898***</td>
<td>0.85***</td>
<td>0.82***</td>
<td>1.05***</td>
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<td>0.95***</td>
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<tr>
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<td>(0.04)</td>
<td>(0.05)</td>
<td>(0.04)</td>
<td>(0.03)</td>
<td>(0.07)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Customers (logged)</td>
<td>-0.06***</td>
<td>-0.16***</td>
<td>-0.09**</td>
<td>-0.08</td>
<td>-0.09***</td>
<td>-0.14**</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.05)</td>
<td>(0.02)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Merger</td>
<td>0.07</td>
<td>0.08***</td>
<td>0.01</td>
<td>0.03</td>
<td>-0.05</td>
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<tr>
<td></td>
<td>(0.05)</td>
<td>(0.03)</td>
<td>(0.06)</td>
<td>(0.04)</td>
<td>(0.09)</td>
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</tr>
<tr>
<td>Deregulated</td>
<td>0.23***</td>
<td>-</td>
<td>-</td>
<td>0.09**</td>
<td>0.32***</td>
<td>0.12**</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td></td>
<td></td>
<td>(0.05)</td>
<td>(0.08)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Industrial</td>
<td>-0.06</td>
<td>0.16**</td>
<td>-</td>
<td>0.11</td>
<td>-0.44**</td>
<td>0.09</td>
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<tr>
<td></td>
<td>(0.10)</td>
<td>(0.07)</td>
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<td>(0.08)</td>
<td>(0.22)</td>
<td>(0.26)</td>
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<tr>
<td>Commercial</td>
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<td>-</td>
<td>0.08</td>
<td>0.27</td>
<td>-0.25</td>
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<tr>
<td></td>
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<td>(0.10)</td>
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<td>(0.11)</td>
<td>(0.24)</td>
<td>(0.36)</td>
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<tr>
<td>Retail</td>
<td>-0.14</td>
<td>-0.22*</td>
<td>-</td>
<td>-0.10</td>
<td>0.14</td>
<td>0.17</td>
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<tr>
<td></td>
<td>(0.14)</td>
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<td>(0.10)</td>
<td>(0.47)</td>
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</tr>
<tr>
<td>Financial Crisis</td>
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<td>-0.01</td>
<td>0.02**</td>
<td>-</td>
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<tr>
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<td>-</td>
<td>-</td>
<td>0.08</td>
<td>0.09</td>
<td>-</td>
</tr>
<tr>
<td>deregulate</td>
<td>(0.03)</td>
<td></td>
<td></td>
<td>(0.05)</td>
<td>(0.09)</td>
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</tr>
<tr>
<td>Financial_Crisis *</td>
<td>-0.08***</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.09***</td>
</tr>
<tr>
<td>deregulate</td>
<td>(0.03)</td>
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<td></td>
<td></td>
<td>(0.02)</td>
</tr>
<tr>
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<td>-0.06*</td>
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<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>merger</td>
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<td>(0.06)</td>
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<td>0.01</td>
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<td>0.01</td>
<td>0.01</td>
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<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>N</td>
<td>549</td>
<td>177</td>
<td>372</td>
<td>300</td>
<td>249</td>
<td>113</td>
</tr>
<tr>
<td>Number of groups</td>
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<td>20</td>
<td>38</td>
<td>50</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td>Chi_Sq</td>
<td>241</td>
<td>144</td>
<td>213</td>
<td>141</td>
<td>101</td>
<td>103</td>
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<tr>
<td>Z score (prob &gt;chi²)</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors are in parentheses. ***, **, and * denote statistical significance levels of 1%, 5%, and 10% respectively. MSE denotes means square error.
Table 6: Regression Results for Factors Influencing Cumulative Abnormal Returns

<table>
<thead>
<tr>
<th></th>
<th>(1) One Year CARs</th>
<th>2) Three year CARs</th>
<th>3) Five Year CARs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deregulated</td>
<td>0.15*</td>
<td>0.21</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.19)</td>
<td>(0.30)</td>
</tr>
<tr>
<td>Transaction</td>
<td>-0.06*</td>
<td>0.01</td>
<td>0.06</td>
</tr>
<tr>
<td>Value log</td>
<td>(0.035)</td>
<td>(0.06)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Multi state merger</td>
<td>0.13</td>
<td>0.13</td>
<td>-0.13</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.23)</td>
<td>(0.48)</td>
</tr>
<tr>
<td>Diversification</td>
<td>0.09</td>
<td>0.28</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.18)</td>
<td>(0.32)</td>
</tr>
<tr>
<td>Early stage period</td>
<td>0.04</td>
<td>0.59**</td>
<td>0.77**</td>
</tr>
<tr>
<td></td>
<td>(0.14)</td>
<td>(0.21)</td>
<td>(0.36)</td>
</tr>
<tr>
<td>N</td>
<td>23</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>R-squared</td>
<td>.18</td>
<td>.49</td>
<td>.42</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors are in parentheses. ***, **, and * denote statistical significance levels of 1%, 5%, and 10% respectively. MSE denotes means square error.